

# Claims

[c1] What is claimed is:

1.A method of determining color composition of an image, the method comprising:  
calculating an intensity value and a saturation value for each pixel of the image;  
comparing the calculated intensity and saturation values for each pixel with first and second predetermined threshold values, respectively;  
labeling pixels with calculated intensity values above the first predetermined threshold value and calculated saturation values above the second predetermined threshold value as color pixels;  
applying a mask to the image and counting the number of color pixels out of the pixels selected by the mask;  
and  
determining that the image is a color image if the number of color pixels selected by the mask is greater than or equal to a predetermined density value.

[c2] 2.The method of claim 1 wherein the intensity value of each pixel is calculated by the formula  $I=(R+G+B)/3$ , where I represents intensity value, R, G, and B respec-

tively represent red, green, and blue color levels.

- [c3] 3.The method of claim 2 wherein the saturation value of each pixel is calculated by the formula  $S=1-\text{Min}(R, G, B)/I$ , where S represents the saturation value and  $\text{Min}(R, G, B)$  selects the minimum color level among the R, G, and B color levels.
- [c4] 4.The method of claim 1 wherein after determining that the image is not a color image, the method further comprises:
  - calculating a first histogram of the intensity values of all of the pixels in the image, the first histogram being divided into a first predetermined number of intensity ranges;
  - choosing an intensity range in the first histogram containing the greatest number of pixels;
  - setting a median value of the chosen intensity range as a background value for the image;
  - updating the intensity values of the pixels in the image by performing a dilation function if the background value is greater than a third predetermined threshold value or performing an erosion function if the background value is less than or equal to the third predetermined threshold value;
  - calculating a second histogram of the updated intensity values of all of the pixels in the image, the second his-

togram being divided into a second predetermined number of intensity ranges; and determining that the image is a black and white image if any one of the intensity ranges in the second histogram contains a number of pixels equal to or greater than a fourth predetermined threshold value, or determining that the image is a gray image otherwise.

- [c5] 5. The method of claim 4 wherein when performing the dilation function, a window is applied to each pixel in the image and the intensity value of a center pixel of the window is replaced according to the equation  
 $I'' = \text{Max}(W(p))$ , where  $I''$  represents the updated intensity of the center pixel,  $W(p)$  represents pixels included in the window around the center pixel, and  $\text{Max}(W(p))$  represents the maximum intensity value of the pixels included in the window.
- [c6] 6. The method of claim 5 wherein the window has dimensions of three pixels by three pixels.
- [c7] 7. The method of claim 4 wherein when performing the erosion function, a window is applied to each pixel in the image and the intensity value of a center pixel of the window is replaced according to the equation  
 $I'' = \text{Min}(W(p))$ , where  $I''$  represents the updated intensity of the center pixel,  $W(p)$  represents pixels included in the

window around the center pixel, and  $\text{Min}(W(p))$  represents the minimum intensity value of the pixels included in the window.

- [c8] 8.The method of claim 7 wherein the window has dimensions of three pixels by three pixels.
- [c9] 9.The method of claim 1 wherein the mask has dimensions of three pixels by three pixels.
- [c10] 10.The method of claim 1 wherein the predetermined density value is equal to seven pixels.